CLAIMS

1. A nucleic acid molecule encoding a fusion polypeptide useful as a vaccine composition, which molecule comprises:

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- (a) a first nucleic acid sequence encoding a first polypeptide or peptide that promotes processing via the MHC class I pathway;
- (b) fused in frame with the first nucleic acid sequence, a second nucleic acid sequence encoding a signal peptide; and
- (c) a third nucleic acid sequence that is linked in frame to said first nucleic acid sequence and that encodes an antigenic polypeptide or peptide.
- 2. The nucleic acid molecule of claim 1, wherein the antigenic peptide comprises an epitope that binds to a MHC class I protein.
- 3.. The nucleic acid molecule of claim 1 wherein the first polypeptide or peptide is Hsp70, an active C-terminal domain thereof, or a functional derivative of Hsp70 or of said C-terminal domain.
- 4. The nucleic acid molecule of claim 1, wherein the first polypeptide is encoded by SEQ ID NO:9 or a fragment thereof that encodes a functional derivative of said polypeptide or the full length sequence of Hsp70 a set forth in GENBANK Z95324 AL123456 and encoded by nucleotides 10633-12510 of the *Mycobacterium tuberculosis* genome.
 - 5. The nucleic acid molecule of claim 1, wherein the first polypeptide is SEQ ID NO:10 of a functional derivative thereof.
 - 6. The nucleic acid molecule of claim 1 wherein the antigen is one which is present on, or/ cross-reactive with an epitope of, a pathogenic organism, cell, or virus.
 - 7. The nucleic acid molecule of claim 6, wherein the virus is a human papilloma virus.
 - 8. The nucleic acid molecule of claim 7, wherein the antigen is an E7 polypeptide of HPV-16 having the sequence SEQ ID NO:2, or an antigenic fragment thereof.
 - 9. The nucleic acid molecule of claim 8, wherein the HPV-16 E7 polypeptide is a non-oncogenic mutant or variant of said E7 polypeptide.
 - 10. The non oncogenic mutant of claim 9 wherein the sequence of the E7 polypeptide differs from SEQ ID NO:2 by one or more of the following substitutions:
 - (a) Cys at position 24 to Gly or Ala

- (b) Glu at position 26 to Gly or Ala
- (c) Cys at position 91 to Gly or Ala.
- 11. The nucleic acid molecule of claim 7, wherein the antigen is the E6 polypeptide of HPV-16 having the sequence SEQ ID NO:4 or an antigenic fragment thereof.
- 12. The nucleic acid molecule of claim 11, wherein the HPV-16 E6 polypeptide is a non-oncogenic mutant or variant of said E6 polypeptide.
- 13. The non oncogenic mutant of claim 12 wherein the sequence of the E6 polypeptide differs from SEQ ID NO:4 by one or more of the following substitutions:
 - (a) Cys at position 70 to Gly or Ala
 - (b) Cys at position 113 to Gly or Ala.
 - (c) Ile at position 135 to Thr

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- 14. The nucleic acid molecule of claim 1 that is characterized as pNGVL4a-Sig/E7(detox)/HSP70, and has the sequence SEQ ID NO:13.
 - 15. The nucleic acid molecule of claim 1 operatively linked to a promoter.
- 16. An expression vector comprising the nucleic acid molecule of any of claims 1-13 operatively linked to
 - (a) a promoter; and
 - (b) optionally, additional regulatory sequences that regulate expression of said nucleic acid in a eukaryotic cell.
 - 17. An expression vector comprising the nucleic acid molecule of claim 14. operatively linked to
 - (a) a promoter; and
 - (b) optionally, additional regulatory sequences that regulate expression of said nucleic acid in a eukaryotic cell.
 - 18. The expression vector of claim 16 which is a plasmid.
 - 19. The expression vector of claim 18 wherein said plasmid is pNGV4a.
 - 20. A pharmaceutical composition capable of inducing or enhancing an antigenspecific immune response, comprising:
 - (a) pharmaceutically and immunologically acceptable excipient in combination with;
 - (b) a composition comprising the nucleic acid molecule of any of claims 1-13.

21. A pharmaceutical composition capable of inducing or enhancing an antigenspecific immune response, comprising:

- (a) pharmaceutically and immunologically acceptable excipient in combination with;
- (b) the nucleic acid molecule of claim 14.
- 5 22. A pharmaceutical composition capable of inducing or enhancing an antigenspecific immune response, comprising:
 - (a) pharmaceutically and immunologically acceptable excipient in combination with;
 - (b) the expression vector of claim 16.
 - 23. A pharmaceutical composition capable of inducing or enhancing an antigenspecific immune response, comprising:
 - (a) pharmaceutically and immunologically acceptable excipient in combination with;
 - (b) the expression vector of claim 19.

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- 24. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 20, thereby inducing or enhancing said response.
- 25. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 21, thereby inducing or enhancing said response.
- 26. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 22, thereby inducing or enhancing said response.
- 27. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 23, thereby inducing or enhancing said response.
- 28. The method of claim 24, wherein the response is mediated at least in part by CD8⁺ cytotoxic T lymphocytes (CTL).
 - 29. The method of claim 24 wherein said subject is a human.
 - 30. The method of claim 25 wherein said subject is a human.
 - 31. The method of claim 26 wherein said subject is a human.
- 32. The method of claim 27 wherein said subject is a human.

33. The method of claim 29 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

- 34. The method of claim 30 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.
- 35. The method of claim 31 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

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- 36. The method of claim 32 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.
- 37. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 20, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.
- 38. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 21, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.
- 39. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 22, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.
- 40. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 23, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.

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